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Field and Imaging Spectroscopy for Monitoring Intertidal Sedimentation Dynamics

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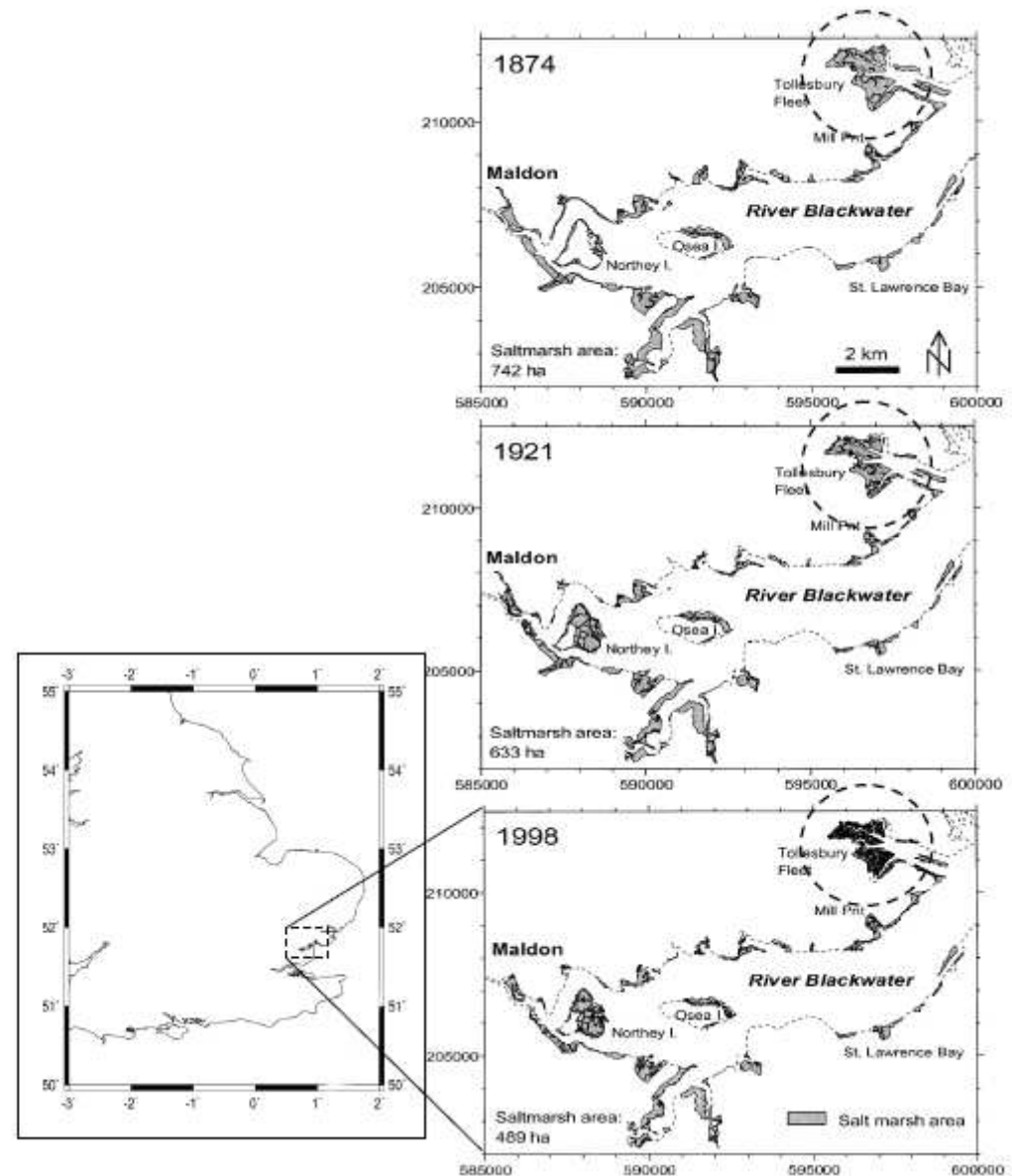


Coastal Erosion

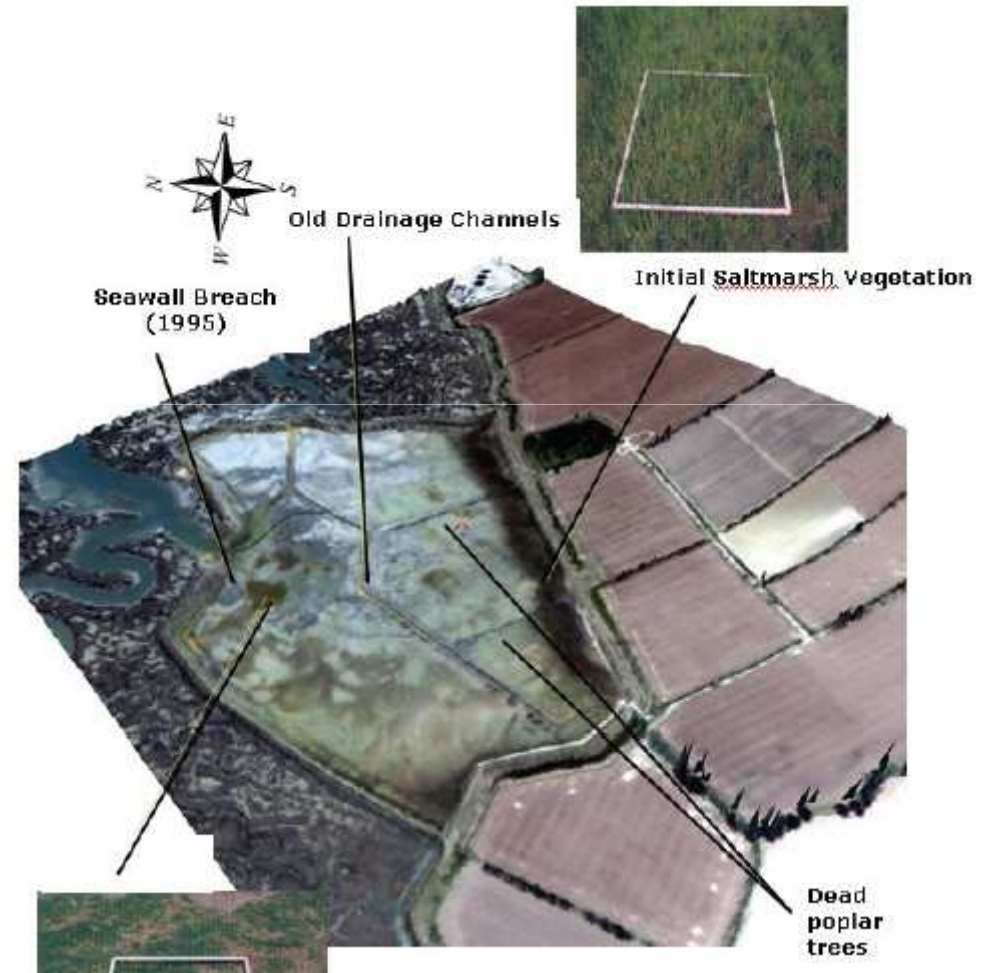
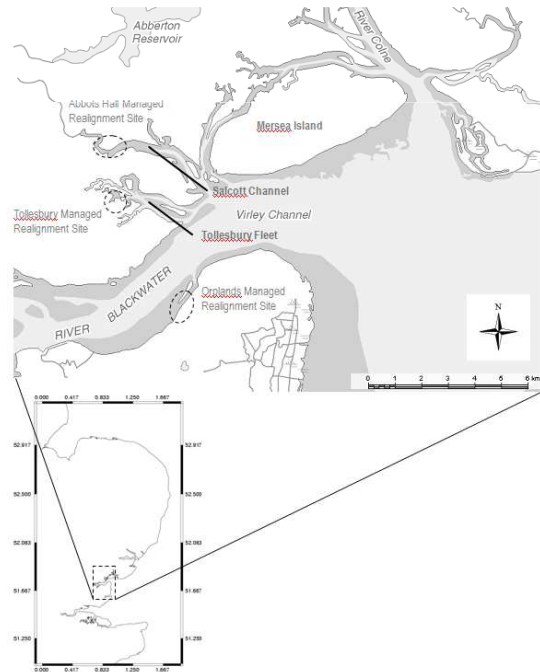
Loss of saltmarsh and
their wave
attenuation capacities

“coastal squeeze”

Need to better
understand intertidal
sedimentation
processes



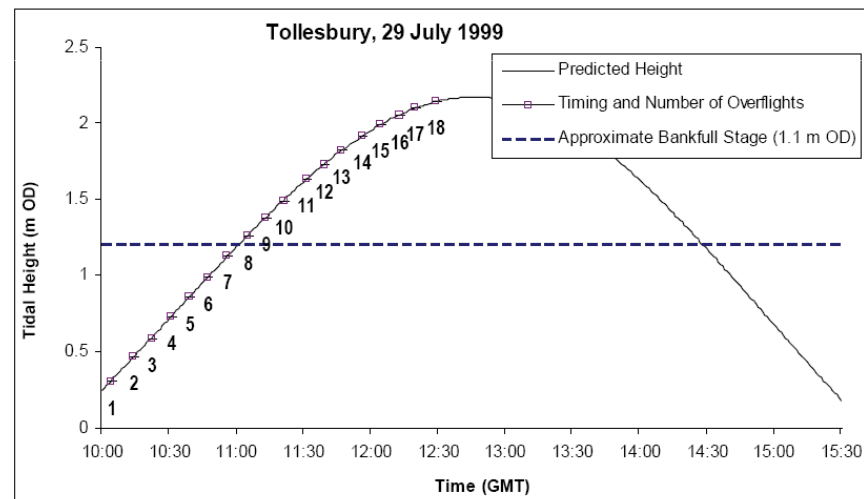
Tollesbury Managed Realignment



Timing of overflights

- Favourable weather conditions need to coincide with tidal conditions
- No concurrent ground reference measurements
- CASI

Band	Start nm	End nm
1	407.5	417.5
2	437.5	447.5
3	485	495
4	505	515
5	555	565
6	615	625
7	660	670
8	677.5	685
9	700	710
10	750	757.5
11	767.5	782.5
12	855	875
13	885	895
14	895	905



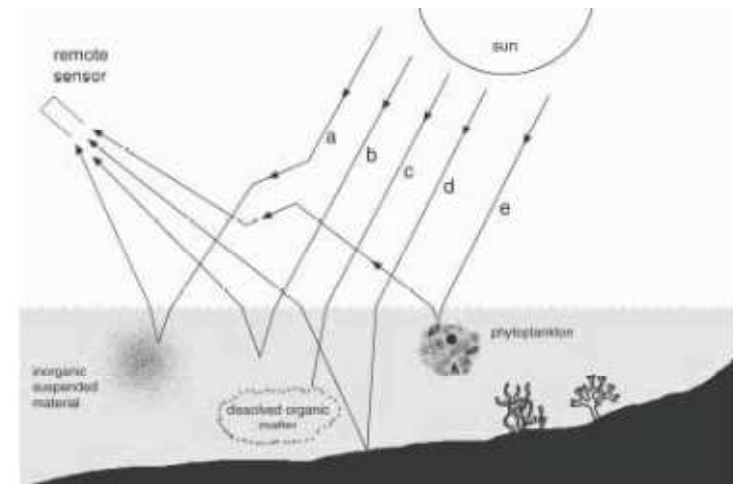
Hydro-optical modelling

- Empirical approaches not feasible
- Need to calibrate physically-based model

- Gordon (1975):
$$R(0) = f \frac{b_b}{a + b_b}$$

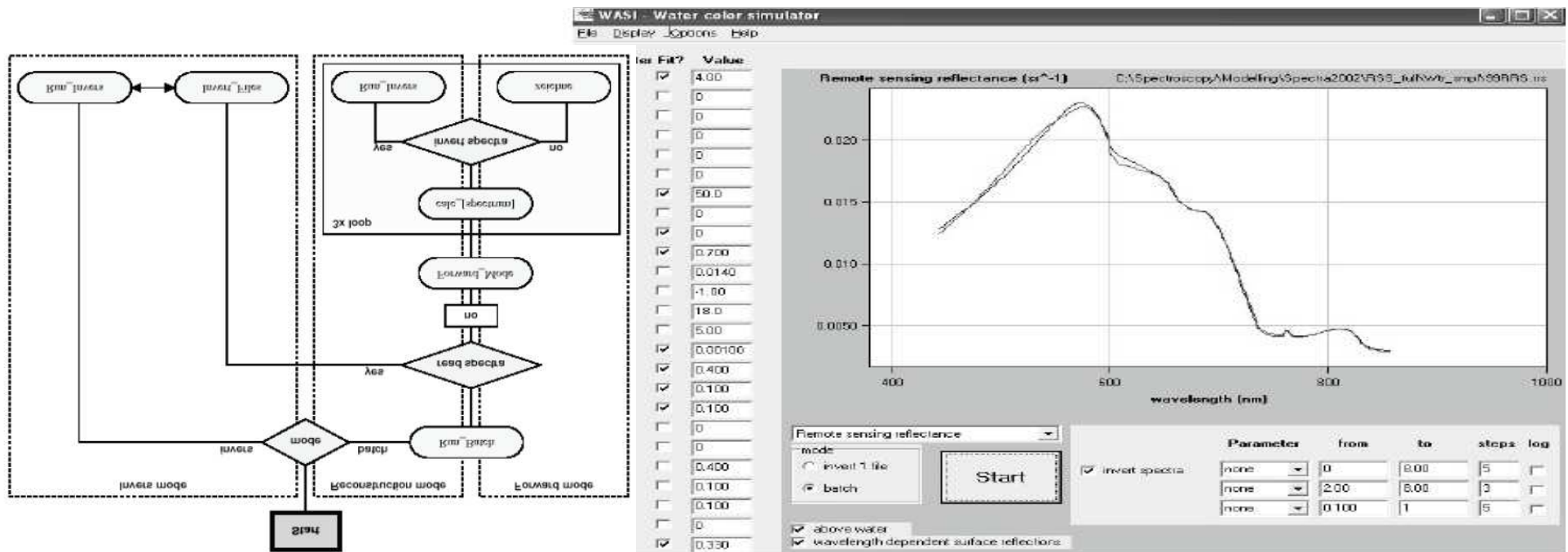
- Retro-active spectral characterisation of water body
- Estimation of inherent optical properties

$$R(0) = f \frac{b_{bw} + Cb_{bc} + Sb_{bs}}{a_w + C a_c + Y a_y + S a_s + b_{bw} + C b_{bc} + S b_{bs}}$$



Parameterising Water Colour Simulator (WASI)

- developed by P. Gege (DLR), initially developed for Lake Constance
- uses non-linear optimization procedures to analyze and simulate a wide range of hydro-optical parameters, including the concentration of suspended particulate matter.
- Can be parameterized for other environments



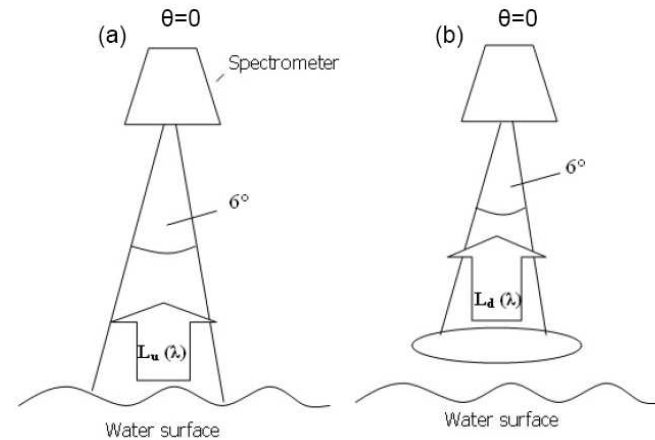
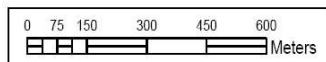
Field Spectroscopy



PIF (a): Bright concrete
Old Hall Farm

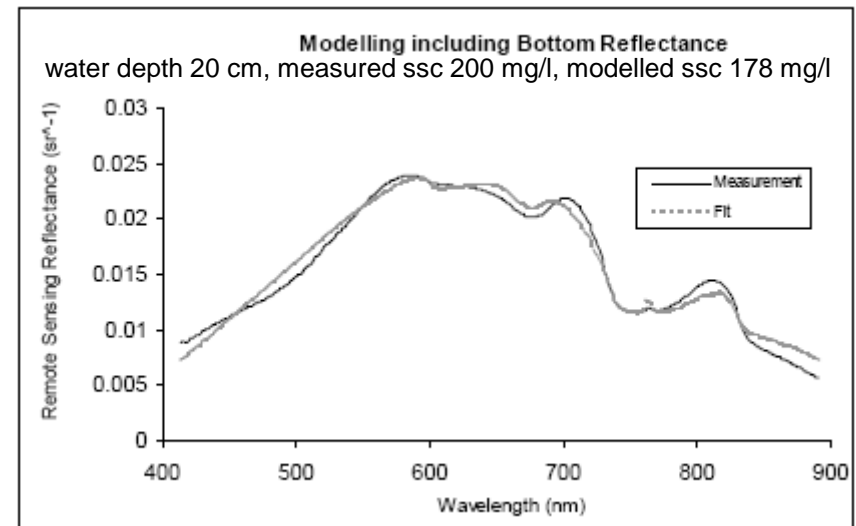
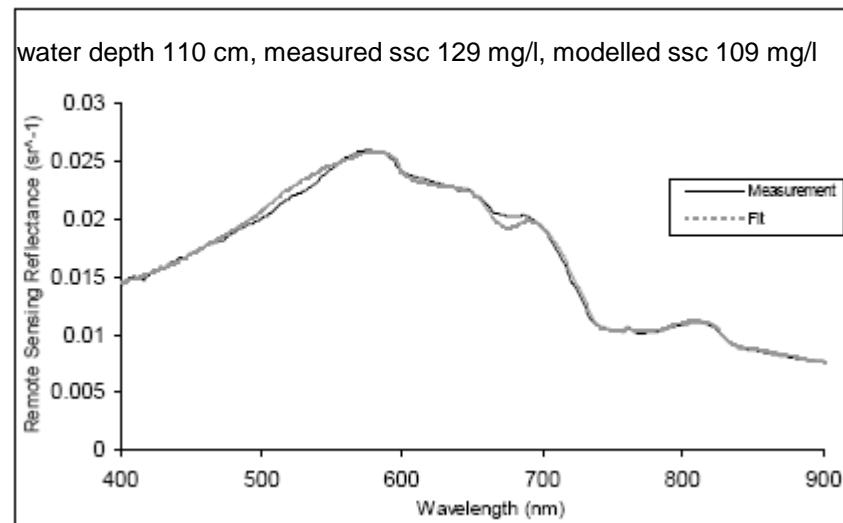
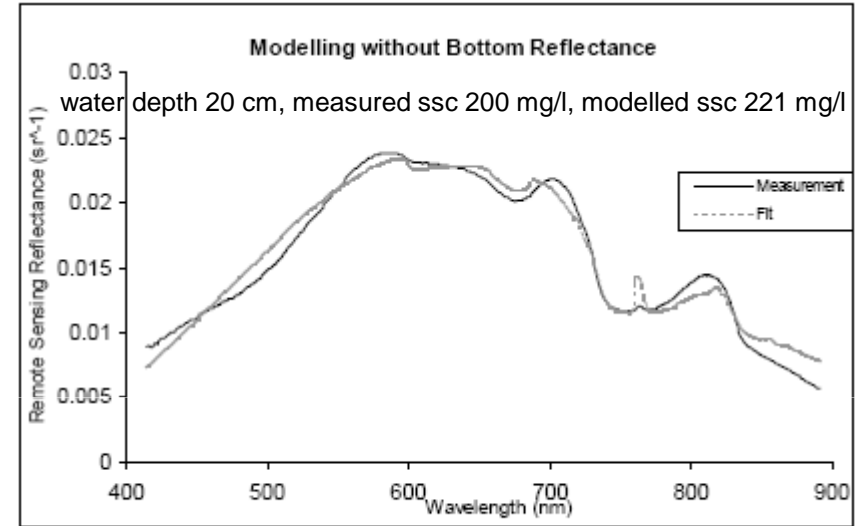
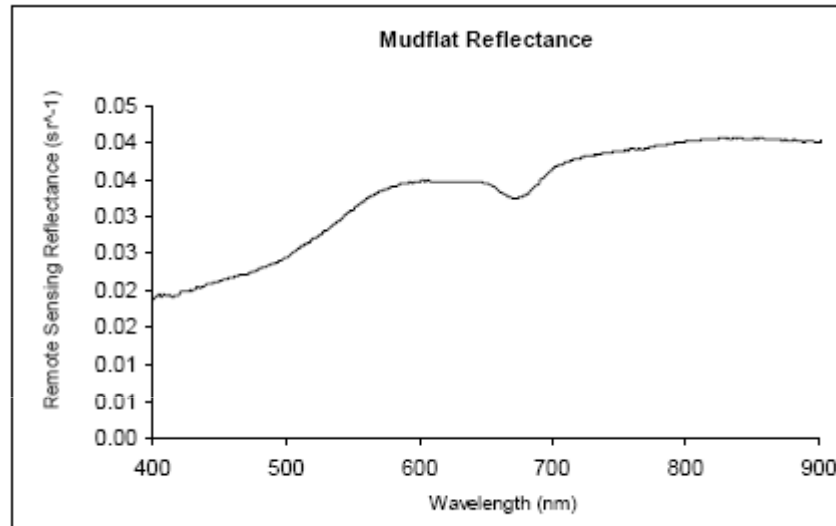
PIF (b): Dark asphalt
at market square

PIF (c): Red surface of
tennis court

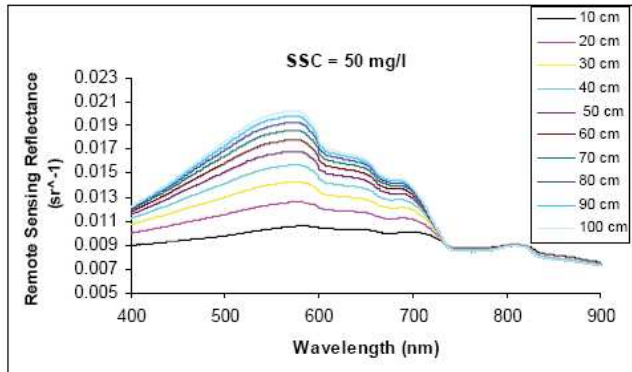
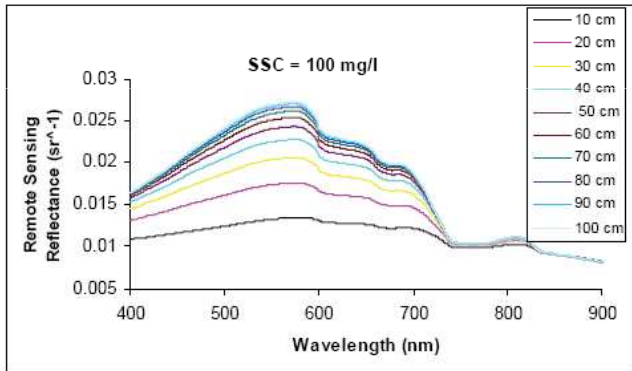
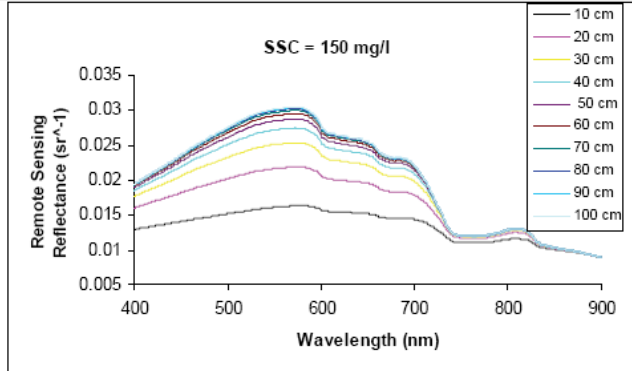
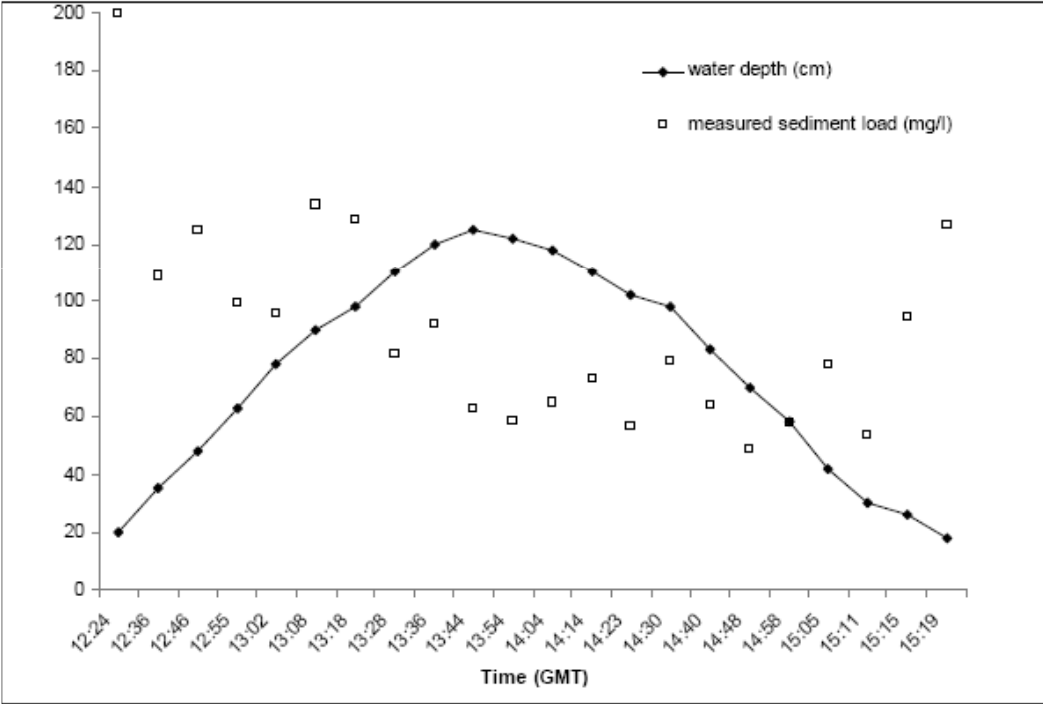


From: IOCCG, 2000

Bottom Reflectance



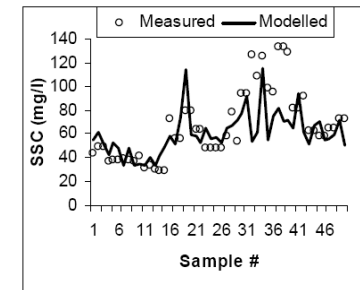
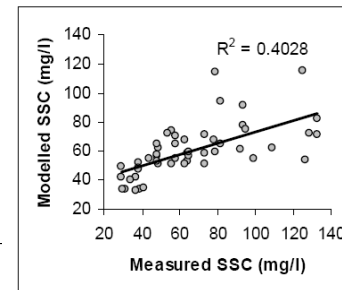
Impact of hyper-turbid layer at initial tidal inundation



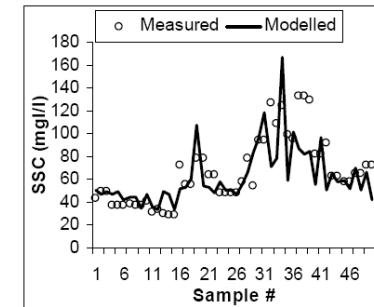
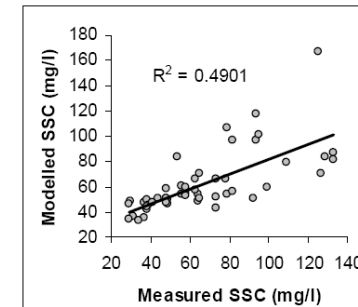
Model Performance

	Field Spectra Full Resolution	Field Spectra CASI Bandset	CASI Flights 2002
Coefficient of Determination (R^2)	0.4	0.49	0.87 ($p > .05$)
Model Efficiency (NS)	0.8	0.83	0.97
Mean Average Error (MAE)	16.5 mg/l	15.3 mg/l	10 mg/l
Normalised Mean Average Error (NMAE)	23%	20.9%	5.5%
Root Mean Squared Error (RMSE)	23.2 mg/l	21.5 mg/l	13 mg/l
Normalised Root Mean Squared Error (NRMSE)	27.4 %	26.4 %	7.5%
Ratio RMSE/MAE	1.41	1.4	1.3
Mean Difference (M)	+6.1 mg/l	+4.4 mg/l	-9.3 mg/l
Relative Difference (R)	+9.1%	+6.6%	-4.9%

Full GER 1500 resolution

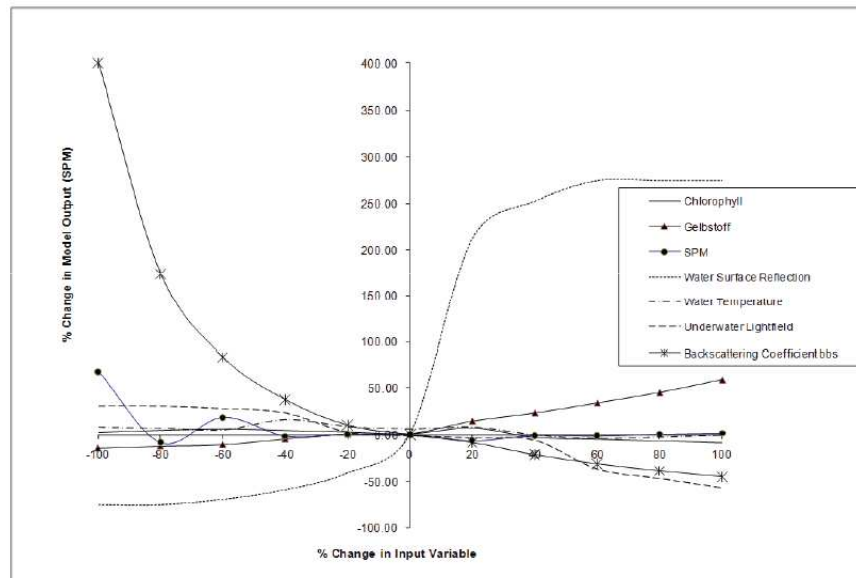


CASI resolution

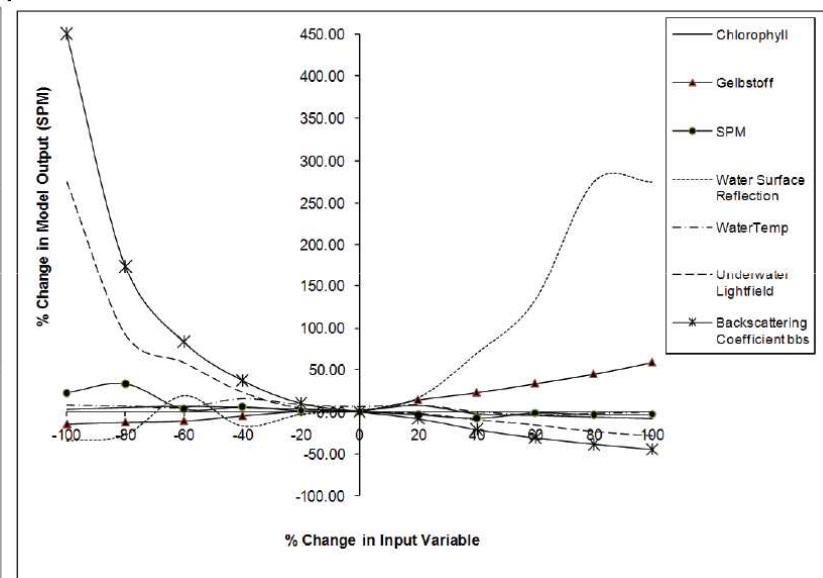


Model Sensitivity

Full GER 1500 resolution

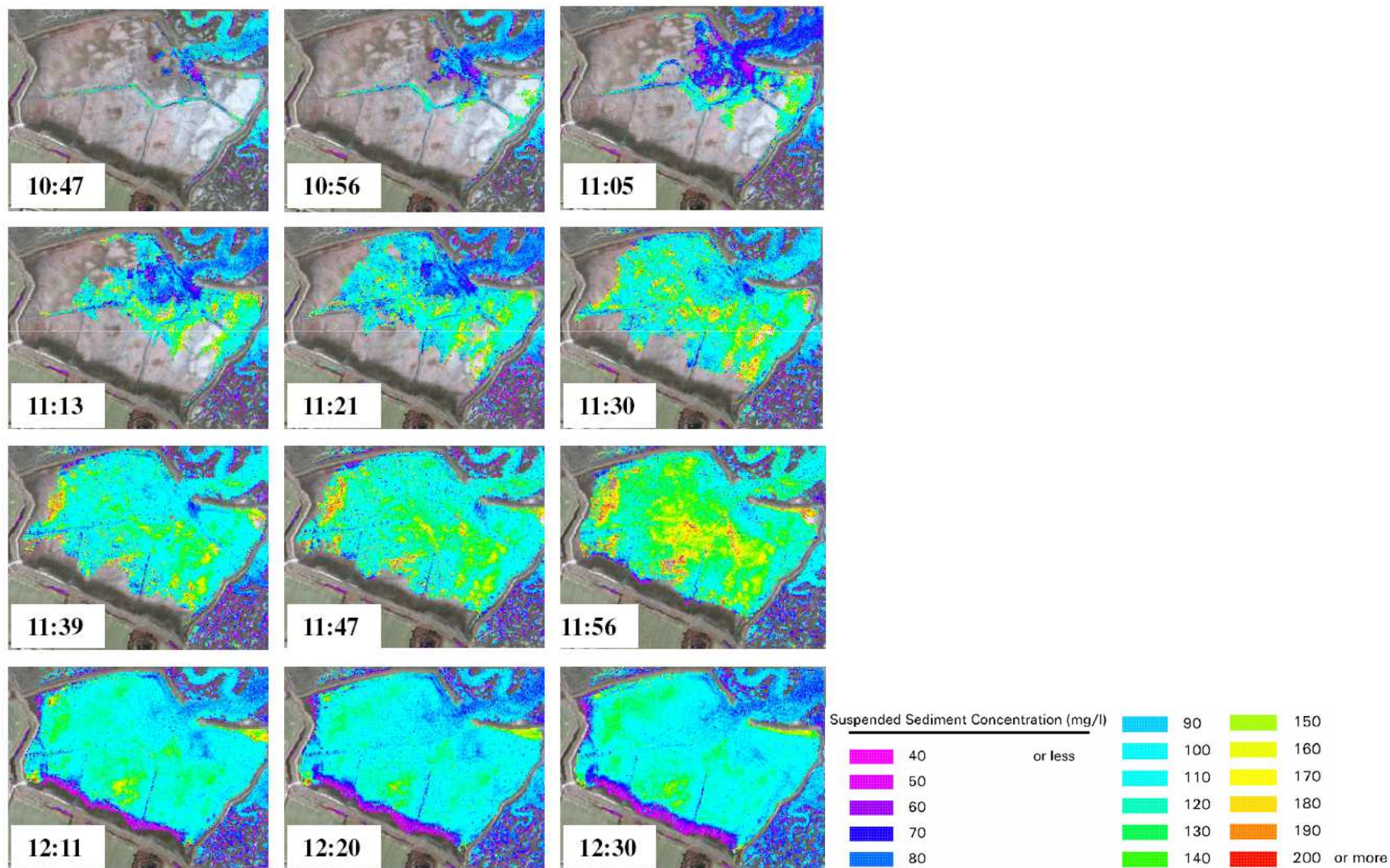


CASI resolution

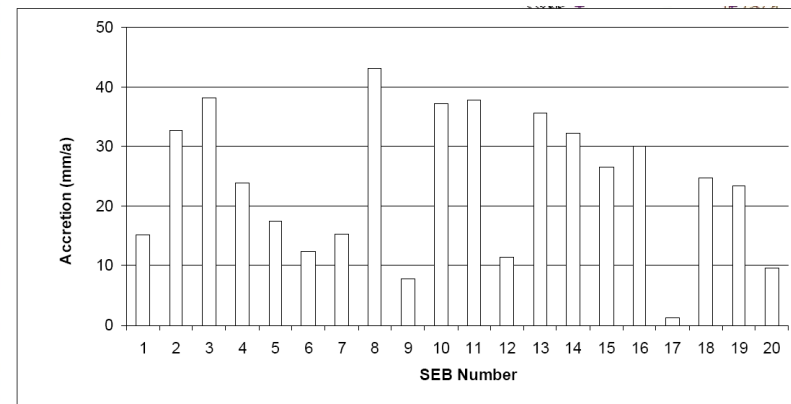
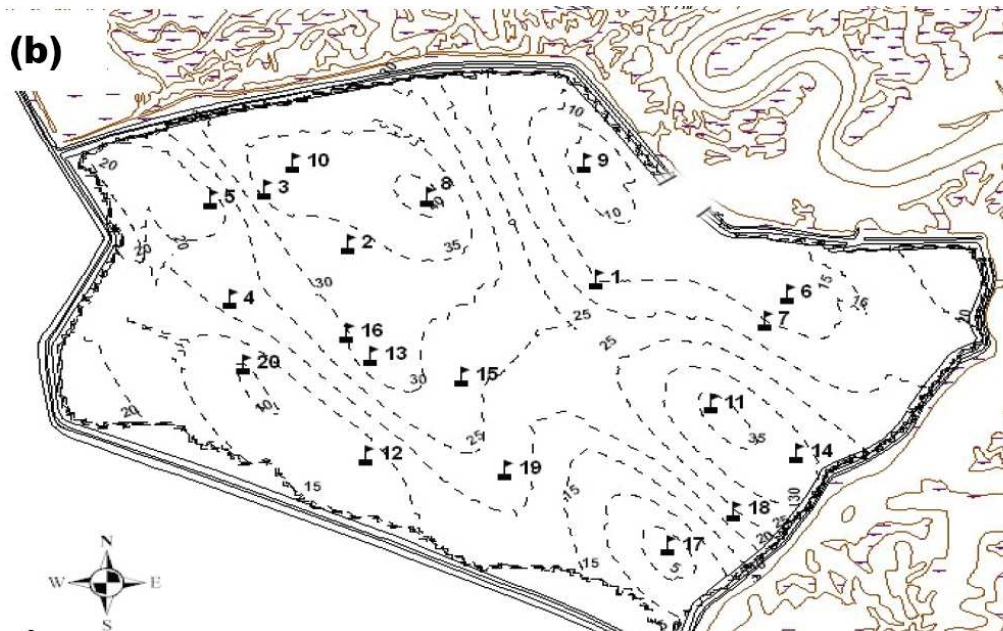
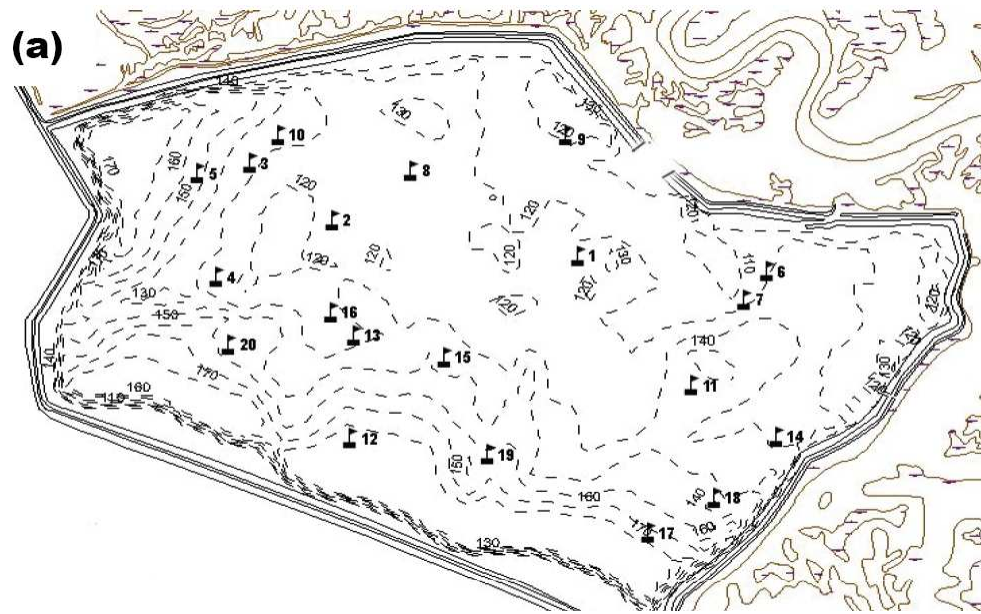


Impact of temporary aggregates/flocculation?

Results

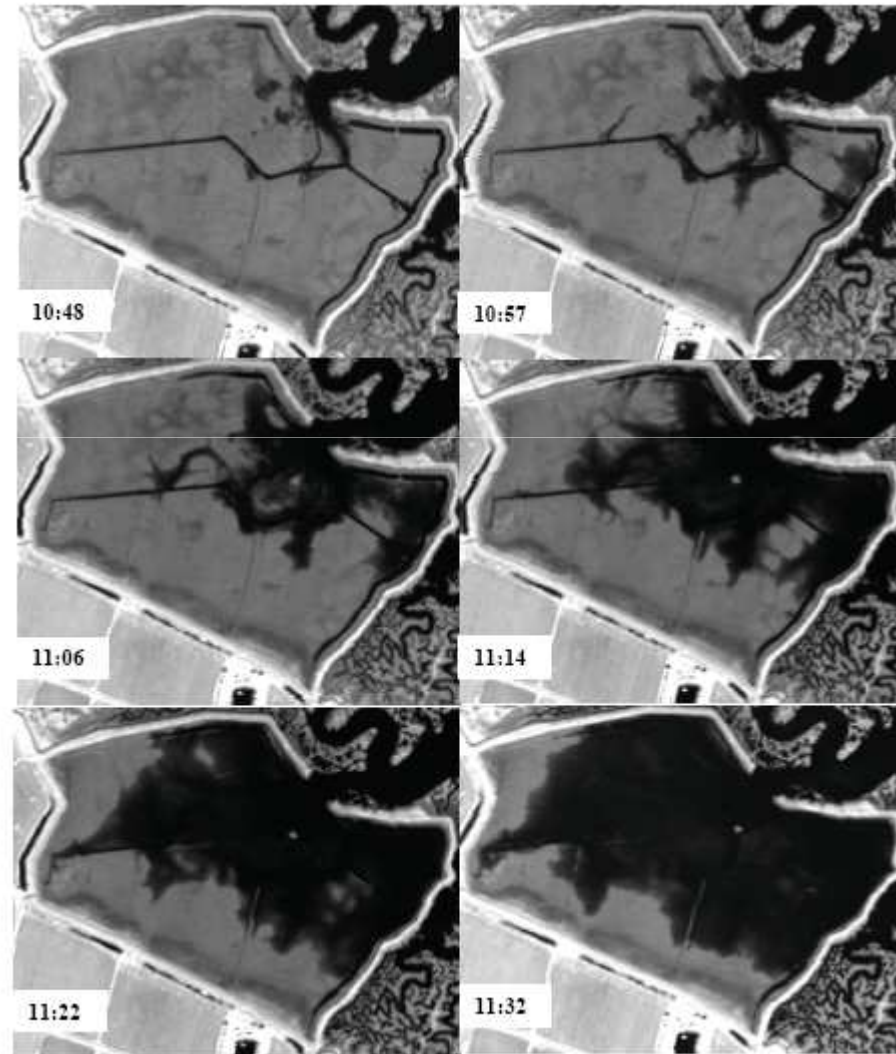


Elevation and Accretion

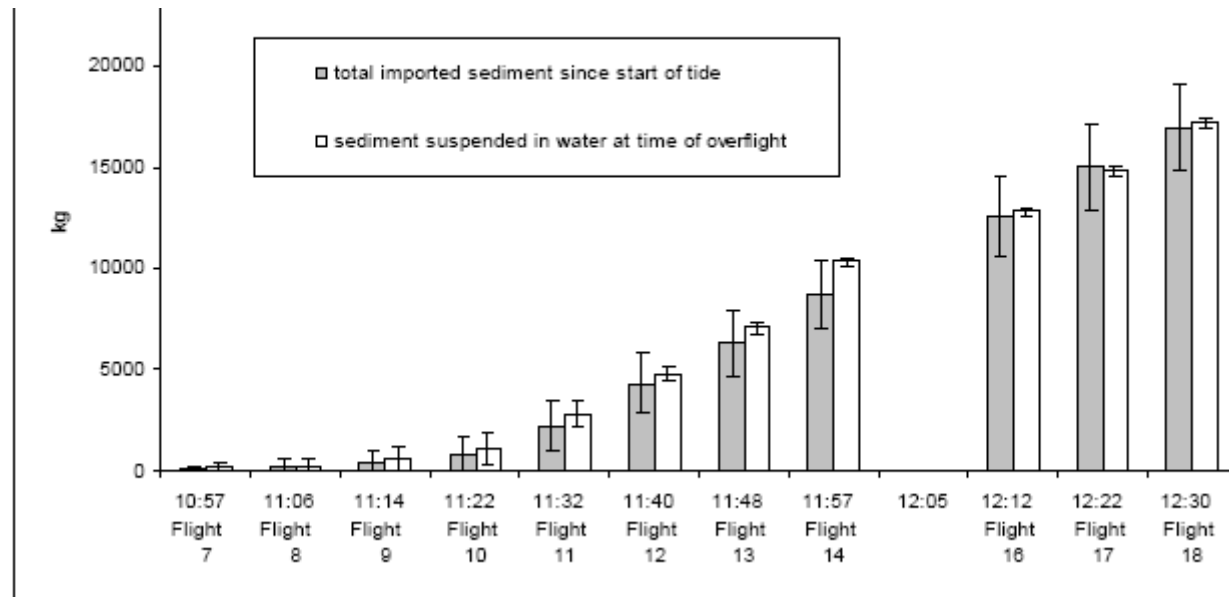
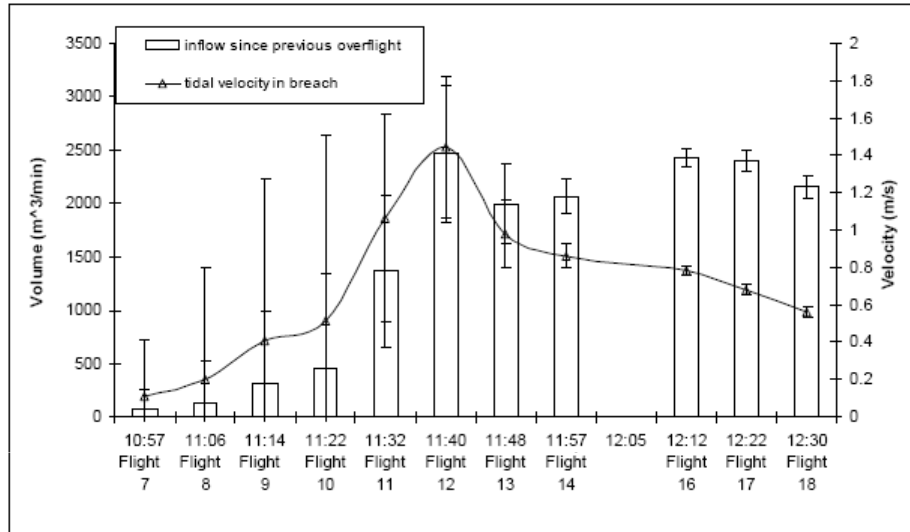


Estimating water levels using waterline method

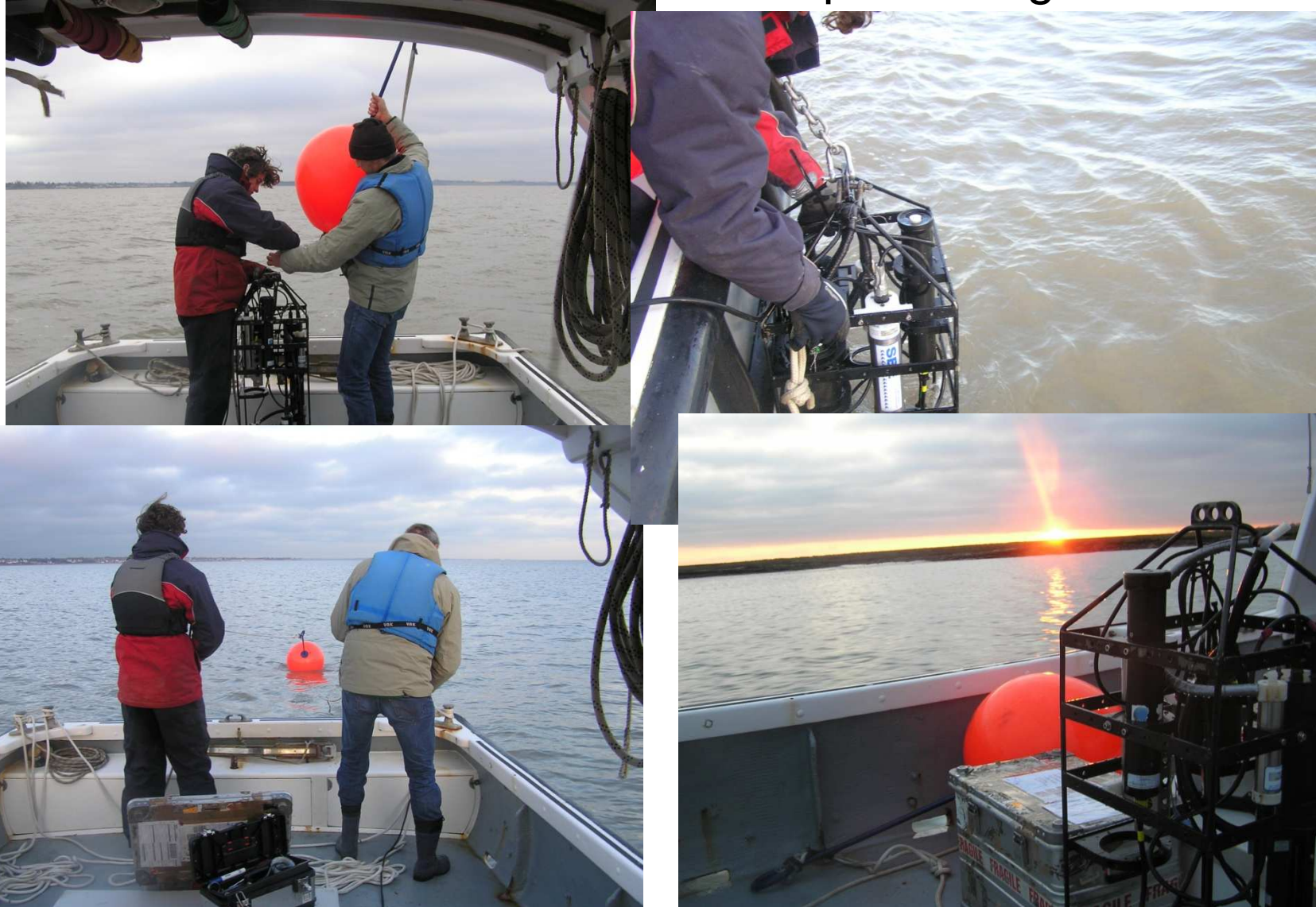
<i>Overflight Number</i>	Mean Elevation (m ODN)	Standard Deviation (cm)	Number of Pixels
6	1.16	8	126
7	1.2	9.2	251
8	1.22	9.1	524
9	1.26	10.9	661
10	1.31	10.8	669
11	1.45	12.9	439
12	1.58	11.6	435
13	1.68	10.9	373
14	1.80	15	310
16	2.03	13.9	276
17	2.16	13.8	257
18	2.28	12.9	201



Quantifying tidal dynamics



Future Research: Investigating impact of tidal spatio-temporal IOP variations on spectral signal



NERC/FSF supported AC-S sampling at Blackwater Estuary

Acknowledgements

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